What is claimed is:

5

10

15

20

25

1. A conductive compound of formula (I) below:

wherein Y is a carbonyl or -NH-; R is one of H, OH, a leaving group, and a probe group; I is an integer from 3 to 6; m is an integer from 1 to 4; and n is an integer from 0 to 3.

- 2. The conductive compound of claim 1, wherein the probe group is a nucleic acid or a protein.
- 3. The conductive compound of claim 2, wherein the probe group is selected from the group consisting of a deoxyribonucleic acid (DNA), a ribonucleic acid (RNA), a peptide nucleic acid (PNA), an antibody, an antigen, an enzyme, a cofactor, and a substrate.
- 4. A method of synthesizing the conductive compound of said formula (I) of claim 1 by reacting a compound of formula (IV) below with thiourea:

$$X + (CH_2)_1 \stackrel{O}{\downarrow} \stackrel{II}{\downarrow} \stackrel{O}{\downarrow} \stackrel{O}{\downarrow} \stackrel{M}{\downarrow} \stackrel{(CH_2)_n}{\downarrow} Y - R$$
...(IV)

wherein Y is carbonyl or -NH-, R is one of H, OH, a leaving group, and a probe group, X is halogen atom, I is an integer from 3 to 6, m is an integer from 1 to 4, and n is an integer from 0 to 3.

5. A method of synthesizing the conductive compound of formula (I) of claim 1, comprising reacting a compound of formula (V) below with a compound of formula (VI) below:

HS
$$+(CH_2) \frac{0}{1} \frac{1}{C} \frac{1}{S} \frac{SnR1R2R3}{m_1} \dots (V)$$

$$X \frac{1}{S} \frac{1}{m_2} \frac{1}{C} \frac{1}{S} \frac{1}{m_2} \frac{1}{m_2$$

wherein R1, R2, and R3 are independently C_1 - C_8 alkyl groups; Y is carbonyl or -NH-group; R is one of H, OH, a leaving group, and a probe group; X is a halogen atom; I is an integer from 3 to 6; m1 and m2 are integers from 1 to 4 and $2 \le m1 + m2 \le 4$; and n is an integer from 0 to 3.

5

10

15

20

- 6. An electrode coated with the conductive compound of said formula (I) of claim 1, the electrode being made of gold.
- 7. A sensor including an electrode coated with the conductive compound of said formula (I) of claim 1, the electrode being made of gold.
 - 8. A target molecule detection method comprising:
 - (a) immobilizing a compound of formula (I) below on a gold substrate to form a self-assembled monolayer;

$$HS - (CH_2) \frac{O}{I} C - (CH_2) \frac{O}{m} (CH_2) \frac{O}{n} Y - R$$
...(I)

wherein Y is a carbonyl or -NH-; R is one of H, OH, a leaving group, and a probe group; I is an integer from 3 to 6; m is an integer from 1 to 4; and n is an integer from 0 to 3;

- (b) reacting a surface of the self-assembled monolayer with probes;
- (c) contacting a target molecule capable of specifically binding to the probes with the probes in the self-assembled monolayer; and
 - (d) measuring an electrical signal from the target molecule-probe complex.

9. A target molecule detection method comprising:

5

10

15

20

(a) immobilizing a compound of formula (I) below on a gold substrate to form a self-assembled monolayer;

$$HS + \left(CH_2\right)_1 C + \left(CH_2\right)_1 Y - R$$

$$\dots (I)$$

wherein Y is a carbonyl or -NH-; R is one of H, OH, a leaving group, and a probe group; I is an integer from 3 to 6; m is an integer from 1 to 4; and n is an integer from 0 to 3;

- (b) contacting a target molecule capable of specifically binding to a probe group R in formula (I) with the probes in the self-assembled monolayer; and
 - (c) measuring an electrical signal from the target molecule-probe comlex.
- 10. The method of claim 8 or 9, wherein the electrical signal is measured from voltage or current variations.
- 11. The method of claim 8 or 9, wherein the probes or the probe group is selected from the group consisting of a deoxyribonucleic acid (DNA), a ribonucleic acid (RNA), a peptide nucleic acid (PNA), an antibody, an antigen, an enzyme, a cofactor, and a substrate.
- 12. The method of claim 8 or 9, wherein the target molecule is a nucleic acid or a protein.